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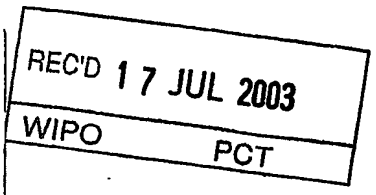

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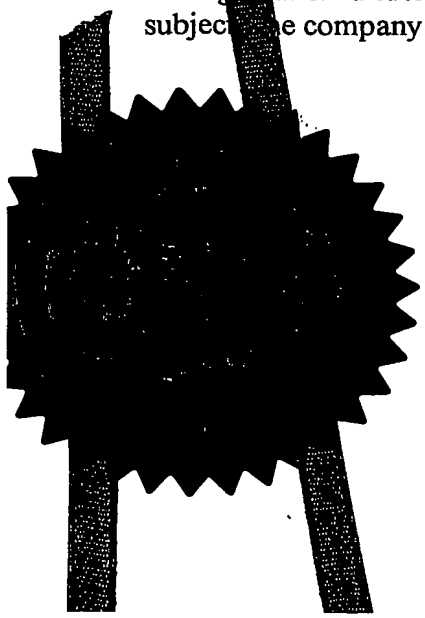

Signed P. Mahoney

Dated 23 June 2003

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Cardiff Road
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1. Your reference

2. Patent application number
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0213388.2
11 JUN 2002

3. Full name, address and postcode of the or of each applicant *(underline all surnames)*
Simon SANDERS
35 Fowler's Road
Salisbury SP1 2QP

Patents ADP number *(if you know it)*
8400624001

If the applicant is a corporate body, give the country/state of its incorporation

4. Title of the invention
Pipeline Rig

5. Name of your agent *(if you have one)*

"Address for service" in the United Kingdom to which all correspondence should be sent *(including the postcode)*
~~35 Fowler's Road~~
~~Salisbury SP1 2QP~~
BARKER BRETTELL
MEDINA CHAMBER
TOWN QUAY
SOUTHAMPTON
SO14 2AA

FS1/77
12-6-03

Patents ADP number *(if you know it)*
7442494001

6. If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or of each of these earlier applications and *(if you know it)* the or each application number	Country	Priority application number *(if you know it)*	Date of filing *(day / month / year)*

7. If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application	Number of earlier application	Date of filing *(day / month / year)*

8. Is a statement of inventorship and of right to grant of a patent required in support of this request? *(Answer 'Yes' if:*
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11. I/We request the grant of a patent on the basis of this application.

Signature [signature] Date 11 June 2002

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PIPELINE PIG

The invention relates to a pipeline pig that may be used to provide a fluid-tight and gas-tight seal within a tubular channel such as a pipe and to apply pressure to the inner surface of a tubular channel, and also relates to the installation of flexible liners within pipes using such a pipeline pig.

A commonly used method for repairing pipes is to insert a flexible tubular liner such as, in the case of the repair of underground drain pipes, a tube of fibrous material such as felt, impregnated with a fluid material such as a resin which, after an interval or as the result of the application of a process such as heating, sets hard. In one embodiment, the invention provides a method for forming a liner against the inner surface of the pipe under repair and for retaining it in position whilst subsequent processes, such as a hardening process, proceed.

According to the invention there is provided a pipeline pig comprising a flexible tubular membrane everted at each end with the two ends brought together and joined around the circumference to form a fully enclosed container and with the enclosed void filled with gas or fluid under pressure or a combination of gas and fluid under pressure. The ratio of the length of the pipeline pig to the circumference of the pipeline pig is such that the pipeline pig is substantially an elongated cylinder in shape over the main part of its length. The pressure of the gas or fluid or combination of gas and fluid in the pipeline pig is sufficient to compress the part of the tubular membrane that passes longitudinally through the middle of the pipeline pig and to close the passage through the middle of the pipeline pig that is formed by the said part of the tubular membrane.

The pipeline pig is circumferentially compressible. If the flexible tubular membrane forming the skin of the pipeline pig consists of an elastic material, the pipeline pig may be filled with gas or fluid or a combination of gas and fluid and compressibility is afforded by the elasticity of the tubular membrane and by the compressibility of the gas, if present. If the flexible tubular membrane consists of a substantially inelastic material, the pipeline pig may be filled with gas or a combination of gas and fluid and compressibility is afforded by the compressibility of the gas.

The pipeline pig may be inserted into a tubular channel such as a pipe where the cross-sectional area of the pipeline pig is greater than the cross-sectional area of the tubular channel in which it is inserted. According to the invention the dimensions of an individual pipeline pig depend on the tubular channel in which it is intended to be used and are such that, when the pipeline pig is inserted into a tubular channel, it presses against the inner surface of the tubular channel around the complete circumference and provides a complete seal within the tubular channel.

By applying a suitable force, the pipeline pig may be caused to move by a longitudinal rolling motion whereby the part of the tubular membrane that passes

through the middle of the pipeline pig moves forwards and emerges at the forward end and spreads to form the outer skin of the pipeline pig. At the same time, the membrane forming the outer skin at the rearward end of the pipeline pig gathers towards the longitudinal axis and is drawn into the middle of the pipeline pig.

In one embodiment of the invention, the pipeline pig is constructed so that any resistance to longitudinal rolling motion inherent in the pipeline pig is minimised. Methods for achieving this include but are not limited to using an elastic tubular membrane of a material with a high degree of flexibility and a smooth, non-sticky surface. In another embodiment of the invention, the pipeline pig is constructed so that inherent resistance to longitudinal rolling motion is enhanced. Methods for achieving this include but are not limited to using a tubular membrane of a substantially inelastic material, using a tubular membrane with a sticky surface and filling the pipeline pig with a gas at a higher pressure than may otherwise be used.

To effect the obstruction or sealing of a designated tubular channel such as a pipe and to apply pressure to the inner surface of the said tubular channel, the invention provides a pipeline pig with dimensions such that, when the pipeline pig is inserted into the said tubular channel, it presses against the inner surface of the said tubular channel around the complete circumference and provides a complete seal within the said tubular channel. This may be achieved by using a pipeline pig with, when uncompressed, a cross-sectional area that is greater than the cross-sectional area of the said tubular channel.

In one embodiment of the invention, a rod or line is provided which passes longitudinally through the middle of the pipeline pig, the surface of the said rod or line providing frictional contact with the pipeline pig. The invention provides a means for propelling the pipeline pig through a tubular channel by pulling on or pushing on the rod or line and, where the pipeline pig is subject to an external propulsive force such as pressure at one end, for restraining the pipeline pig in the tubular channel by restraining the rod or line, and for propelling the pipeline pig against an external propulsive force by pulling on or pushing on the rod or line in the opposing direction, using a force sufficient to overcome the external propulsive force.

In one embodiment, the invention provides a means for propelling a pipeline pig through a tubular channel by introducing a pressurising medium consisting of gas or fluid under pressure or a combination of gas and fluid under pressure into the tubular channel at one end of the pipeline pig sufficient to overcome any inherent resistance to longitudinal rolling motion in the pipeline pig, causing the pipeline pig to be propelled in the direction away from the end that is in contact with the pressurising medium. The invention provides a means for slowing, stopping or reversing the motion of the pipeline pig thus caused by introducing a pressurising medium consisting of gas or fluid or a combination of gas and fluid into the tubular channel at the other end of the pipeline pig under pressure sufficient to cause the motion of the pipeline pig to be slowed, stopped or reversed.

The invention provides an end-cap for attachment to either end of the tubular channel

formed so that it is gas-tight or fluid-tight and may be attached to the tubular channel by a gas-tight or fluid-tight joint and may be constructed so that it can be opened readily for ease of access to the interior of the tubular channel. The end-cap may contain one or more apertures through which a pressurising medium such as a gas or a fluid or a combination of gas and fluid may be introduced into the tubular channel. The end-cap may contain one or more devices for regulating the pressure of a pressurising medium such as a gas or a fluid or a combination of gas and fluid within the tubular channel, such as a pressure relief valve. The end-cap may contain one or more apertures such as a gland through which rods, lines, cables or tubes or devices such as but not limited to sources of heat, light and other forms of radiation, cameras and detection and measuring devices and cutters and manipulators may be inserted into and withdrawn from the interior of the tubular channel without significant leakage of or loss of pressure in any pressurising medium such as a gas or a fluid or a combination of gas and fluid within the tubular channel. The end-cap may contain provision for retaining one or more devices such as but not limited to sources of heat, light and other forms of radiation, cameras and detection and measuring devices and cutters and manipulators and for deploying them within the tubular channel without significant leakage of or loss of pressure in any pressurising medium such as a gas or a fluid or a combination of gas and fluid within the tubular channel.

In order to facilitate the introduction of a pipeline pig into a tubular channel and to introduce a pressurising medium such as gas or fluid or a combination of gas and fluid into the void between the near end of the pipeline pig and the near end of the tubular channel, the invention provides an end-chamber, substantially cylindrical in shape, closed at one end and open at the other. The end-chamber is substantially similar in cross-sectional area to the tubular channel into which the pipeline pig is to be introduced and is of a length sufficient to accommodate the pipeline pig. The open end of the end-chamber is formed so that it may be connected to the end of the tubular channel by a gas-tight or fluid-tight joint. A pressurising aperture is provided at the closed end of the end-chamber through which a pressurising medium such as gas or fluid or a combination of gas and fluid may be introduced under pressure into the end-chamber. A method is provided whereby the pipeline pig is positioned within the end-chamber, the open end of the end-chamber is connected to the end of the tubular channel by a gas-tight or fluid-tight joint, and gas or fluid or a combination of gas and fluid under pressure is introduced through the pressurising aperture into the void between the near end of the pipeline pig and the closed end of the end-chamber, propelling the pipeline pig out of the end chamber and into and through the tubular channel.

The end-chamber may contain additional features as follows:

1. One or more access apertures such as a gland through which a rod, cable, tube, line or other devices, including but not limited to cameras, heating devices, light sources, ultra-violet radiation sources, cutting devices and manipulation devices for deploying within the tubular channel, including devices connected to rods, cables, tubes or lines, may be introduced into the chamber from outside the chamber and may be removed from within the chamber.

2. One or more devices for measuring and controlling the pressure of any gas or fluid or combination of gas or fluid within the end-chamber.

3. Provision for accommodating and deploying devices including but not limited to cameras, heating devices, light sources, ultra-violet radiation sources, cutting devices and manipulation devices for deploying within the tubular channel, including devices connected to rods, cables, tubes or lines passing through the said access apertures.

4. One or more pressurising apertures at the open end of the end-chamber through which gas or fluid or a combination of gas and fluid may be introduced into the void at the remote end of the pipeline pig.

In order to introduce a pressurising medium such as a gas or a fluid or a combination of gas and fluid into the void in the tubular channel at the remote end of the pipeline pig, the following alternative methods may be provided:

1. Means for introducing the pressurising medium through an aperture at the remote end of the tubular channel.

2. A pass-through tube which passes through the passage which passes longitudinally through the middle of the pipeline pig, through which the pressurising medium may be passed. The pass-through tube may be used to restrain the pipeline pig in a fixed position or may be lubricated so that it may be withdrawn. If the pass-through tube is to be withdrawn, it may be necessary to use alternate means for holding the pipeline pig in a fixed position as the pressure of the pressurising medium increases.

3. A bypass tube which passes longitudinally between the inner surface of the tubular channel and the pipeline pig. The bypass tube is constructed of a thin membrane or, if a harder material is used, shaped so as to minimise or eliminate any leakage of gas or fluid between the void in the tubular channel at one end of the pipeline pig and the void in the tubular channel at the other end of the pipeline pig

4. An end-chamber wherein there is a pressurising aperture located near to the open end, through which the pressurising medium may be passed into the void at the remote end of a pipeline pig positioned within the said end-chamber. A second pressurising aperture may be provided at the closed end of the end-chamber for introducing the pressurising medium into the void between the near end of the pipeline pig and the closed end of the end-chamber.

In order to facilitate the recovery of a pipeline pig following its passage through a tubular channel and to maintain the pressure of a pressurising medium such as gas or fluid or a combination of gas and fluid into the void between the remote end of the pipeline pig and the remote end of the tubular channel, the invention provides a [illegible]

sufficient to accommodate the pipeline pig. The open end of the receiving chamber is formed so that it may be connected to the end of the tubular channel by a gas-tight or fluid-tight joint. A pressure control device such as a pressure relief valve is provided which controls the pressure of the pressurising medium such as gas or fluid or combination of gas and fluid in the void between the remote end of the pipeline pig and the remote end of the tubular channel. The receiving chamber may be made of flexible material.

In the embodiment of the invention that relates to lining pipes, a flexible liner is positioned within a pipe being lined and a pipeline pig is introduced into the liner at the near end of the liner. Means are provided for introducing gas or fluid or a combination of gas and fluid under pressure into the void in the liner between the near end of the liner and the near end of the pipeline pig, which propels the pipeline pig through the liner towards the remote end of the liner, spreading and pressing the liner against the inner surface of the pipe being lined. The pressure of the gas or fluid or combination of gas and fluid in the void in the liner between the near end of the liner and the near end of the pipeline pig is maintained at a level sufficient to keep the liner pressed against the inner surface of the pipe being lined following the passage of the pipeline pig. In order to ensure that the pipeline pig does not move through the liner at a rate sufficient to cause a reduction in the pressure of the gas or fluid or combination of gas and fluid in the void in the liner between the near end of the liner and the near end of the pipeline pig there are provided means of restraining the movement of the pipeline pig as follows, which may be used singly or in combination:

1. A rod or flexible line is provided which passes longitudinally through the pipeline pig and the motion of the pipeline pig through the liner is controlled by restraining the said rod or flexible line.

2. Means are provided for applying pressurised gas or fluid or a combination of gas and fluid in the void in the liner between the remote end of the liner and the remote end of the pipeline pig and the motion of the pipeline pig is controlled by controlling the relative pressures of the gas or fluid or combination of gas and fluid in the voids at either end of the pipeline pig.

3. A pipeline pig with enhanced inherent resistance to longitudinal rolling motion is used, necessitating the use of raised pressure in the gas or fluid or combination of gas and fluid in the void in the liner between the near end of the liner and the near end of the pipeline pig in order to propel the pipeline pig through the liner.

According to an alternative method provided by the invention, a rod or line is provided which passes longitudinally through a pipeline pig which has been constructed so as to exhibit enhanced resistance to longitudinal rolling motion. The pipeline pig is positioned within the liner. Means are provided for applying gas or fluid in the void in the liner between the remote end of the liner and the remote end of the pipeline pig at a pressure sufficient to keep the liner pressed against the inner surface of the pipe being lined following the passage of the pipeline pig but insufficient to propel the pipeline pig through the liner. Means are provided for

pulling on or pushing on the rod or line, thereby propelling the pipeline pig through the liner.

A receiving chamber made of a flexible material may be provided, attached to a liner by a gas-tight or fluid-tight joint, which may be inserted into a pipe being lined together with the liner to which it is attached, thereby providing a method for inserting, spreading and pressing a liner against the inner surface of a pipe being lined, using access from one end only of the pipe being lined.

A connecting tube of a flexible material and of substantially similar diameter to the liner may be used to connect a liner and an end-cap or an end-chamber or a receiving chamber or any other form of pressure-tight seal for containing the pressure of a pressurising medium such as a gas or a fluid within the liner. Such a connecting tube is joined to the liner and to the end-cap or end-chamber or receiving chamber or other form of pressure-tight seal by gas-tight or fluid-tight joints.

The invention will now be described in detail with reference to the accompanying drawings in which:

Figure 1 shows a pipeline pig in general view

Figure 2 shows a pipeline pig positioned within a tubular channel and shows how the pipeline pig may be propelled through the tubular channel by adjusting the pressure of gas or fluid in the tubular channel on one or both sides of the pipeline pig.

Figure 3 shows a rod or line passing through the passage through the middle of a pipeline pig which is positioned within a tubular channel and shows how the rod or line may be used to move and restrain the pipeline pig within the tubular channel.

Figure 4 shows in longitudinal cross-sectional view a pipe being lined, a liner within the pipe being lined and a pipeline pig within the liner and shows how the pipeline pig may be used in conjunction with a pressurising medium to spread, press and retain the liner against the inner surface of the pipe being lined.

Figure 5 shows in longitudinal cross-sectional view a pipe being lined, a liner within the pipe being lined, a pipeline pig within the liner and rod or line passing longitudinally through the middle of the pipeline pig and shows how the pipeline pig in conjunction with the rod or line and a pressurising medium may be used to spread, press and retain the liner against the inner surface of the pipe being lined.

Figure 6 shows in longitudinal cross-sectional view a pipe being lined, a liner within the pipe being lined and a pipeline pig within the liner and shows how the pipeline pig in conjunction with pressurising media may be used to spread, press and retain the liner against the inner surface of the pipe being lined.

Figure 7 shows a pipeline pig positioned within a tubular channel and shows a pass-through tube positioned within the pipeline pig.

Figure 8 shows a pipeline pig positioned within a tubular channel and shows a bypass tube positioned between the inner surface of the tubular channel and the pipeline pig.

Figure 9 shows an end-chamber, a pipeline pig positioned within the end-chamber and the position of two pressurising apertures on the end chamber.

Figure 10 shows a receiving chamber attached to a tubular channel, a pipeline pig positioned within the receiving chamber and a pressure control device attached to the receiving chamber.

In the drawings, the following reference numbers refer to features of the invention as follows:

1. A pipeline pig
2. The flexible tubular membrane from which the pipeline pig is constructed
3. The first end of the tubular membrane from which the pipeline pig is constructed
4. The second end of the tubular membrane from which the pipeline pig is constructed
5. The gas-tight or fluid-tight joint by which the first end and the second end of the tubular membrane from which the pipeline pig is constructed are joined
6. The enclosure within the pipeline pig resulting from everting the tubular membrane and joining the ends of the tubular membrane with a gas-tight or fluid-tight joint
7. The part of the tubular membrane that passes through the middle of the pipeline pig
8. The passage through the middle of the pipeline pig that is formed by the part of the tubular membrane that passes through the middle of the pipeline pig
9. A tubular channel
10. The near end of the pipeline pig
11. The direction in which the pipeline pig is propelled
12. The remote end of the pipeline pig
13. A rod or line
14. The direction in which a force is applied to the rod or line to propel the pipeline pig

15. The direction in which a force is applied to the rod or line to slow, arrest or reverse the motion of the pipeline pig

16. A liner

17. A pipe being lined

18. The near-end void in the liner

19. The near end of the liner

20. The remote-end void in the liner

21. A pass-through tube

22. A bypass tube

23. An end-chamber

24. The open end of the end-chamber

25. A first pressurising aperture

26. A second pressurising aperture

27. The closed end of the end-chamber

28. A receiving chamber

29. A gas-tight or fluid-tight joint connecting the receiving chamber and the tubular channel

30. A pressure control device such as a pressure relief valve

31. The closed end of the receiving chamber

As shown in Figure 1 the pipeline pig 1 consists of a flexible tubular membrane 2, everted at each end, where the first end 3 and the second end 4 have been brought together and joined around the circumference by a gas-tight or fluid-tight joint 5 and the resulting enclosure 6 has been filled with gas or fluid under pressure or a combination of gas or fluid under pressure. The part 7 of the membrane that passes through the middle of the pipeline pig 1 forms a passage 8 through the middle of the pipeline pig 1. The part 7 of the membrane that passes through the middle of the pipeline pig 1 is compressed so that the passage 8 is closed thereby.

Figure 2 shows a pipeline pig 1, compressed and positioned within a tubular channel 9. Pressure is exerted by the pipeline pig 1 against the inner surface of the channel 9.

pressure into the tubular channel 9 at the near end 10 of the pipeline pig 1 by means not shown in Figure 2, the pipeline pig 1 may be propelled through the tubular channel 9 in the direction 11 shown. If pressurising media such as gas or fluid are introduced under pressure into the tubular channel 9 at both the near end 10 and the remote end 12 of the pipeline pig 1, the pipeline pig 1 may be propelled through the tubular channel 9 in the said direction 11 by adjusting the pressures of the said pressurising media so that the pressure of the pressurising medium in the tubular channel 9 at the near end 10 of the pipeline pig 1 is greater than the pressure of the pressurising medium in the tubular channel 9 at the remote end 12 of the pipeline pig 1 by an amount sufficient to overcome any resistance to longitudinal rolling motion inherent in the pipeline pig 1.

As shown in Figure 3, a pipeline pig 1 is compressed and positioned within a tubular channel 9. A rod or line 13 passes longitudinally through the passage 8 through the middle of the pipeline pig 1. There is frictional contact between the rod or line 13 and the pipeline pig 1 where they are in contact in the passage 8 in the middle of the pipeline pig 1. By applying a force to the rod or line 13 in the direction 14 shown, the pipeline pig 1 may be propelled in the direction 11 shown. By restraining the rod or line 13, the motion of the pipeline pig 1 may be restrained. If a pressurising medium such as a gas or fluid under pressure is introduced into the tubular channel 9 at the near end 10 of the pipeline pig 1 by means not shown in Figure 3, propelling the pipeline pig 1 through the tubular channel 9 in the direction 11 shown, the motion of the pipeline pig 1 may be slowed, arrested or reversed by applying a force to the rod or line 10 in the direction 15 shown.

Figure 4 shows a liner 16, positioned within a pipe being lined 17 and a pipeline pig 1 is positioned within the liner 16. A pressurising medium consisting of gas or fluid or a combination of gas and fluid is introduced under pressure into the near-end void 18 in the liner 16, which is the void enclosed by the liner 16 between the near end 19 of the liner 16 and the near end 10 of the pipeline pig 1 and retained by means not shown in this Figure 4 propelling the pipeline pig 1 in the direction 11 shown. As the pipeline pig 1 moves in the direction 11 shown, it spreads the liner 16 and presses it against the inner surface of the pipe being lined 17. The pressure of the pressurising medium in the near-end void 18 that is required to propel the pipeline pig 1 in the direction 11 shown depends on the inherent resistance to longitudinal motion of the pipeline pig 1. If the pipeline pig 1 is constructed so as to be sufficiently inherently resistant to longitudinal motion, the pressure of the pressurising medium in the near-end void 18 may be maintained at a level that ensures that the segment of the liner 16 between the near end 19 of the liner 16 and the near end 10 of the pipeline pig 1 continues to be pressed against the inner surface of the pipe being lined 17 following the passage of the pipeline pig 1 through the said segment of the liner 16.

As shown in Figure 5, a liner 16 is positioned within a pipe being lined 17, a pipeline pig 1 is positioned within the liner 16 and rod or line 13 passes longitudinally through the middle of the pipeline pig 1. A pressurising medium consisting of gas or fluid or a combination of gas and fluid is introduced under pressure into the near-end void 18 in the liner 16, which is the void enclosed by the liner 16 between the near end of the liner and the near end 10 of the pipeline pig 1 and is retained by means not shown in Figure 5. Means not shown in Figure 5 are provided for applying a force to the rod or

line 13 in the direction 14 shown. Pressure within the pressurising medium in the near-end void 18 propels the pipeline pig 1 in the direction 11 shown. As the pipeline pig 1 moves in the direction 11 shown, it spreads the liner 16 and presses it against the inner surface of the pipe being lined 17. The rate at which the pipeline pig 1 moves in the direction 11 shown may be controlled by applying a restraining force to the rod or line 13 in the direction 14 shown and thereby any reduction in the pressure of the pressurising medium in the near-end void 18 due to movement of the pipeline pig 1 may be controlled. The pressure of the pressurising medium in the near-end void 18 is maintained at a level that ensures that the segment of the liner 16 between the near end 19 of the liner 16 and the near end 10 of the pipeline pig 1 continues to be pressed against the inner surface of the pipe being lined 17 following the passage of the pipeline pig 1 through the said segment of the liner 16.

As shown in Figure 6, a liner 16 is positioned within a pipe being lined 17 and a pipeline pig 1 is positioned within the liner 16. A pressurising medium consisting of gas or fluid or a combination of gas and fluid is introduced under pressure into the remote-end void 20 in the liner 16, which is the void enclosed by the liner 16 between the remote end 12 of the pipeline pig 1 and the remote end of the liner 16 (not shown), which is the end of the liner 16 furthest from the near end 19 of the liner 16, and retained by means not shown in this Figure 6. A pressurising medium consisting of gas or fluid or a combination of gas and fluid is introduced under pressure into the near-end void 18 in the liner 16, which is the void enclosed by the liner 16 between the near end 19 of the liner 16 and the near end 10 of the pipeline pig 1, at a pressure that is greater than the pressure of the pressurising medium in the remote-end void 20 and retained by means not shown in this Figure 6. The difference between the pressure of the pressurising medium in the near-end void 18 and the pressure of the pressurising medium in the remote-end void 20 is sufficient to propel the pipeline pig 1 in the direction 11 shown. Means not shown in this Figure 6 are provided for controlling the pressures of the pressurising media in the near-end void 18 and the remote-end void 20 which may include but are not limited to means for introducing additional gas or fluid under pressure into the near-end void 18 and the remote-end void 20 and means for the release of controlled quantities of the pressurising media from the near-end void 18 and the remote-end void 20. As the pipeline pig 1 moves in the direction 11 shown, it spreads the liner 16 and presses the liner 16 against the inner surface of the pipe being lined 17. The pressure of the pressurising medium in the near-end void 18 is maintained at a level that ensures that the segment of the liner 16 between the near end of the liner 16 and the near end 10 of the pipeline pig 1 continues to be pressed against the inner surface of the pipe being lined 17 following the passage of the pipeline pig 1 through the said segment of the liner 16.

As shown in Figure 7, a pipeline pig 1 is compressed and positioned within a tubular channel 9. A pass-through tube 21 passes longitudinally through the passage 8 through the middle of the pipeline pig 1. There may be frictional contact between the pass-through tube 21 and the pipeline pig 1 where they are in contact in the passage 8 in the middle of the pipeline pig 1 which may be reduced by lubrication or by wrapping the pass-through tube 21 in a lubricated tube or wrapper (not shown). A pressurising medium such as a gas or fluid under pressure may be introduced into the

Figure 8 shows a pipeline pig 1 compressed and positioned within a tubular channel 9. A bypass tube 22 passes longitudinally between the inner surface of the tubular channel 9 and the pipeline pig 1. A pressurising medium such as a gas or fluid under pressure or a combination of gas and fluid under pressure may be introduced into the tubular channel 9 at the remote end 12 of the pipeline pig 1 by passing it through the bypass tube 22.

Figure 9 shows an end-chamber 23 within which a pipeline pig 1 is positioned. The open end 24 of the end chamber 23 is formed so that it may be attached to a tubular channel (not shown) by a gas-tight or fluid-tight joint. A first pressurising aperture 25 is located near to the open end 24 of the end-chamber 23, between the remote end 12 of the pipeline pig 1 and the open end 24 of the end-chamber 23. A second pressurising aperture 26 is located at the closed end 27 of the end-chamber 23. A pressurising medium such as a gas or fluid under pressure or a combination of gas and fluid under pressure may be introduced into the end chamber 23 through both the first pressurising aperture 25 and the second pressurising aperture 26.

Figure 10 shows a receiving chamber 28 attached to a tubular channel 9 by a gas-tight or fluid-tight joint 29. A pipeline pig 1 is positioned within the receiving chamber 28. A pressure control device such as a pressure relief valve 30 is located at the closed end 31 of the receiving chamber, by means of which the pressure of the pressurising medium such as a gas or a fluid or a combination of gas and fluid in the tubular channel 9 is controlled as the pipeline pig 1 progresses through the tubular channel 9.

Figure 3

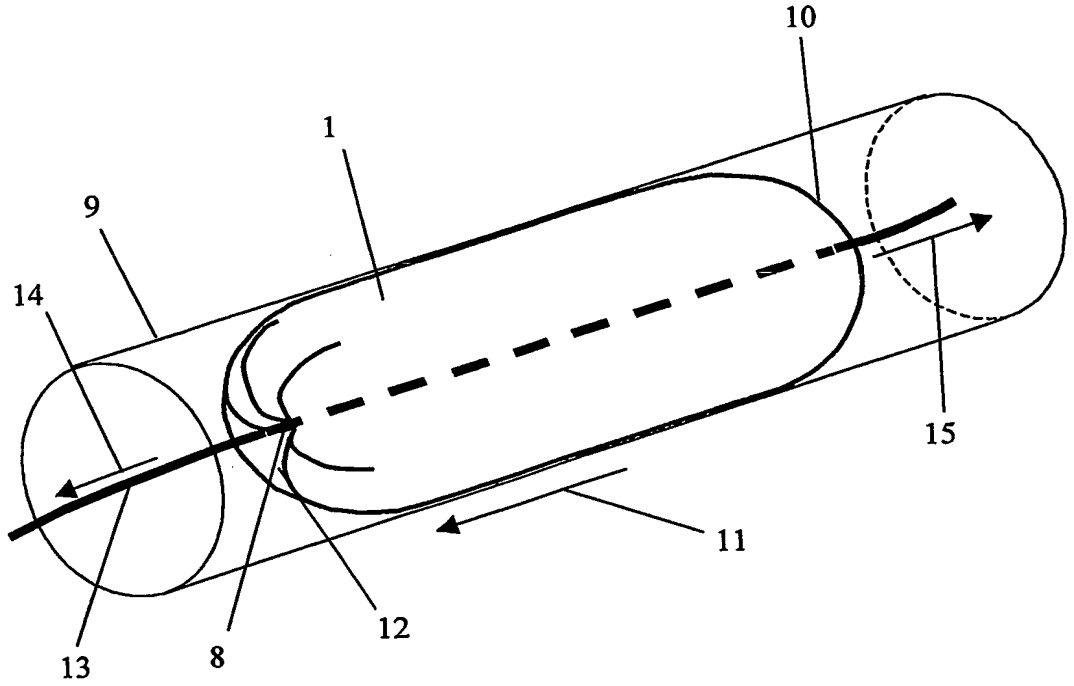

Figure 4

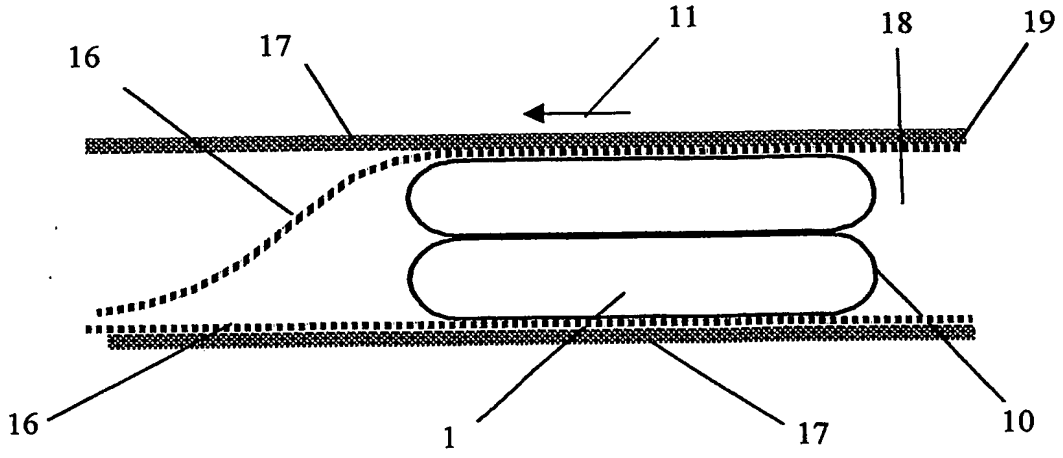

Figure 5

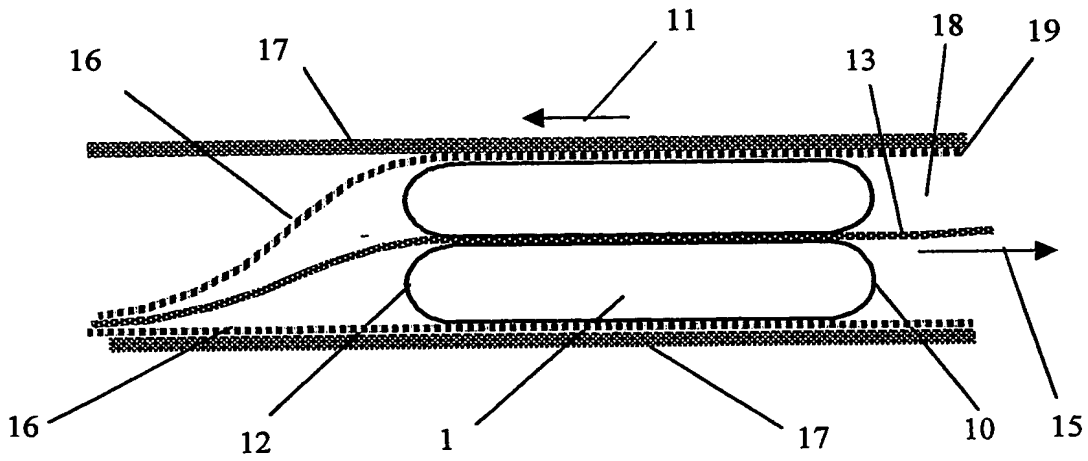

Figure 6

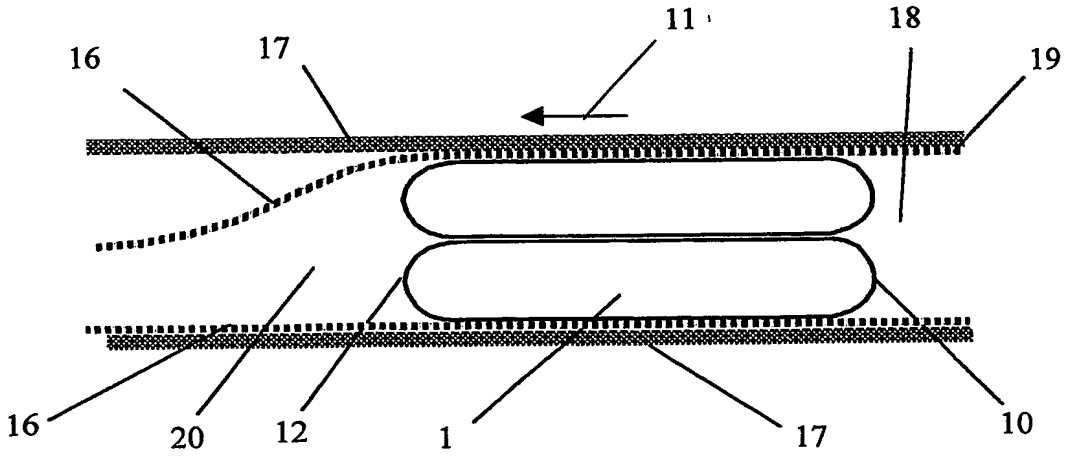

Figure 7

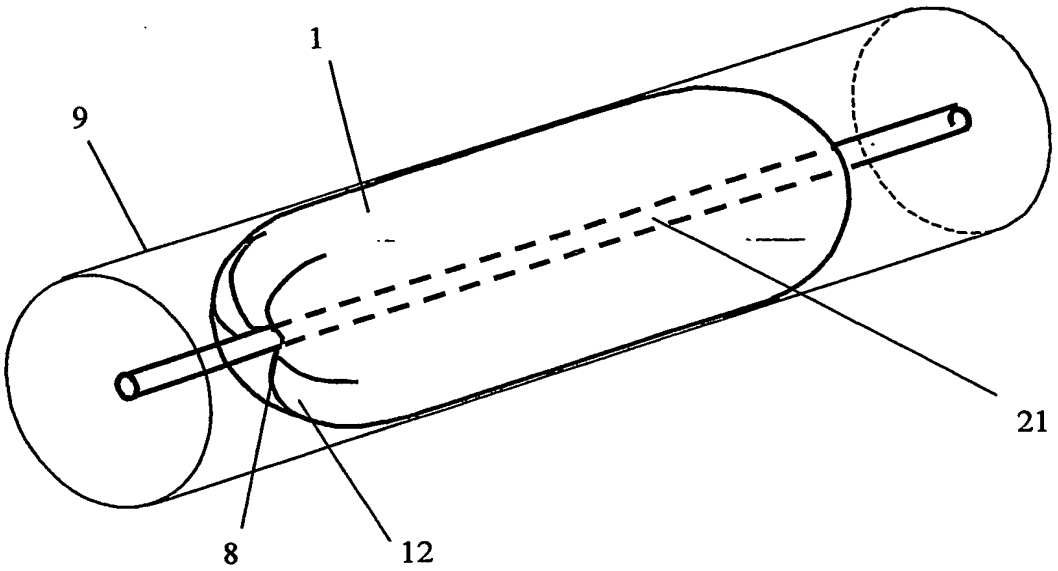

Figure 8

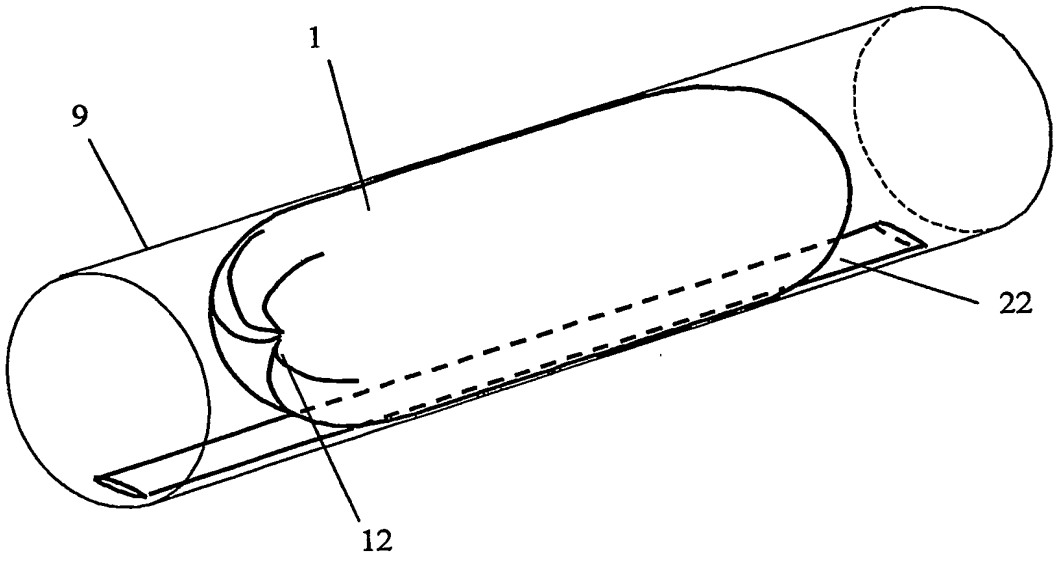

Figure 9

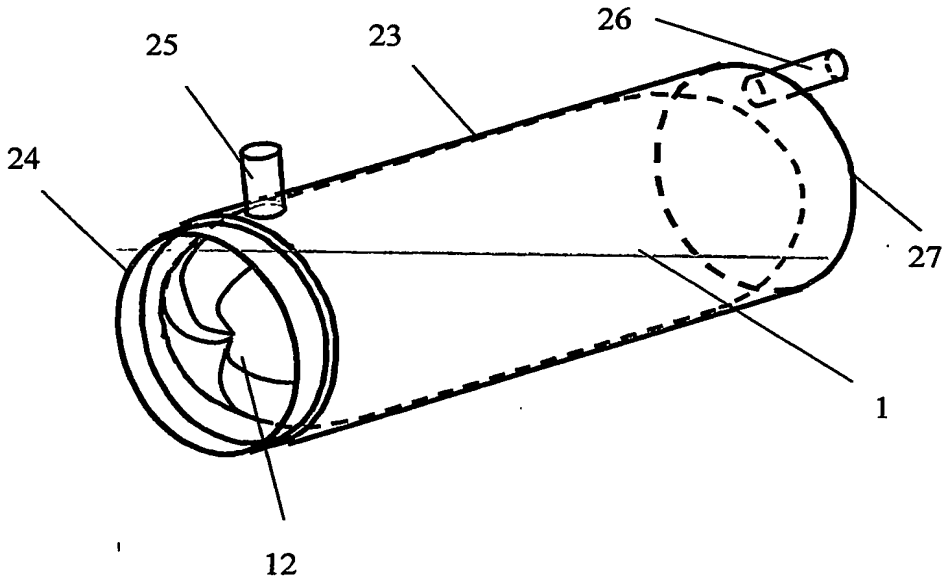

Figure 10